

The Impact of Carbon Dioxide Concentration on Science and Hardware Design for Life Sciences Research on Space Station Freedom. Catherine C. Johnson, Michael Horkachuck, NASA/Ames Research Center and Robert W. Phillips, NASA Headquarters

Space Station Freedom will provide an opportunity to conduct life sciences research on plants and animals for long duration. Studies will be able to assess the impact of the microgravity environment over multiple generations for both plants and animals. For animals, one will be able to determine the rate of change of various processes, e.g., calcium loss from bones, muscle atrophy. For plants, one will be able to study the effect of microgravity on respiration and transpiration. However, all of these processes may be perturbed by the 5.3 mm Hg (0.7 %) partial pressure of CO₂ currently specified for Space Station Freedom. The specifications for the plant and animal habitats which will comprise part of the Centrifuge Facility are for the CO₂ level within the plant habitat to be controlled over the range of 300 to 2000 ppm \pm 10-50 ppm and that the atmospheric composition (CO₂ level) within the rodent habitat not exceed the upper and lower cabin CO₂ limits by more than 1 % of the cabin partial pressure. This latter specification was established based on the assumption that the CO₂ level would be similar to the 0.03 % on Earth. If other than a closed loop is used for the plant habitat, e.g., use of cabin air for filler gas, this will require scrubbing the cabin air to remove the excess CO₂. The animal habitats may require increased airflow, from that required in general practice or for other design considerations, to minimize buildup of CO₂ to even higher levels within the animal habitat. An analysis showing the impact of different cabin CO₂ levels on the CO₂ levels within the animal habitats as a function of air flow rate is presented as well as a discussion of the effects of elevated levels of CO₂ on animal physiology.